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09/549,432	04/14/2000	Fausto Bernardini	YOR000084US1	9324

7590 07/08/2004  
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EXAMINER

DAY, HERNG DER

ART UNIT	PAPER NUMBER
2128	

DATE MAILED: 07/08/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

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## Office Action Summary

Application No.

09/549,432

Applicant(s)

BERNARDINI ET AL.

Examiner

Herng-der Day

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 14 April 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 April 2000 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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### DETAILED ACTION

1. Claims 1-30 have been examined and claims 1-30 have been rejected.

#### *Drawings*

2. The Draftsperson has objected to the drawings. Please see the copy of Form PTO 948 for an explanation.

#### *Abstract*

3. The abstract of the disclosure is objected to because it exceeds 150 words in length. Correction is required. See MPEP § 608.01(b).

#### *Specification*

4. The disclosure is objected to because of the following informalities:  
Appropriate correction is required.
  - 4-1. It appears that “a memory subsystem 110”, as described in line 8 of page 8, should be “a memory subsystem 114”.
  - 4-2. It appears that “a system bus 112”, as described in lines 9-10 of page 8, should be “a system bus 116”.
  - 4-3. A section entitled “Multiple Passes”, as described in line 13 of page 14 and line 19 of page 15, cannot be found in the specification.

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4-4. It appears that “from P1 to PK-1”, as described in line 22 of page 19, should be “from PI to PK-1”.

4-5. It appears that “vertex 920”, as described in line 19 of page 20, should be “edge 920”.

5. The incorporation of essential material in the specification by reference to a foreign application or patent, or to a publication is improper. Applicant is required to amend the disclosure to include the material incorporated by reference. The amendment must be accompanied by an affidavit or declaration executed by the applicant, or a practitioner representing the applicant, stating that the amendatory material consists of the same material incorporated by reference in the referencing application. See *In re Hawkins*, 486 F.2d 569, 179 USPQ 157 (CCPA 1973); *In re Hawkins*, 486 F.2d 579, 179 USPQ 163 (CCPA 1973); and *In re Hawkins*, 486 F.2d 577, 179 USPQ 167 (CCPA 1973).

5-1. The attempt to incorporate essential material into this application by reference to F. Bernardini and C. Bajaj, “Sampling and reconstructing manifolds using alpha-shapes”, Proc. of the Ninth Canadian Conference on Computational Geometry, Aug. 1997, pp. 193-198, as described in lines 13-16 of page 12, is improper because it is not (1) a U.S. patent, (2) a U.S. patent application publication, or (3) a pending U.S. application.

6. The Examiner requests a copy of the following publication referred to in the specification because they appear to be reasonably necessary to the examination of this application and cannot be found.

(1) F. Bernardini and C. Bajaj, “Sampling and reconstructing manifolds using alpha-shapes”, Proc. of the Ninth Canadian Conference on Computational Geometry, Aug. 1997, pp. 193-198, referred to in lines 13-16 of page 12.

*Claim Rejections - 35 USC § 112*

7. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 1-30 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

8-1. Claims 1, 27, and 29 recite the limitation “repeating said pivoting and adding steps until said surface is reconstructed”. However, as described in lines 24-26, page 5 of the specification, “The ball-pivoting operation continues until all reachable edges have been tried, and then starts from another seed triangle, until all scan points have been considered”. Accordingly, without undue experimentation, it is unclear for one skilled in the art whether the surface of an object will be reconstructed without also repeating the “finding a seed triangle” step.

8-2. Claims 2-13 are rejected as being dependent on the rejected claim 1.

8-3. Claims 14, 28, and 30 recite the limitation “keep(ing) said ball in contact with two points on the active-edge front of said mesh and pivoting said ball until it touches another point in said scan data, said two contact points forming an edge”. Unless the two contact points on the active-edge front of the mesh are adjacent, “said two contact points forming an edge” will form a new edge and divide the active-edge front. Accordingly, without undue experimentation, it is unclear for one skilled in the art how to reconstruct the surface by pivoting the ball as claimed.

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8-4. Claims 15-26 are rejected as being dependent on the rejected claim 14.

9. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. Claims 4, 10-12, and 15-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

10-1. Claim 4 recites the limitation “the point set” in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

10-2. Claim 10 recites the limitation “the same voxel” in line 2 of the claim. There is insufficient antecedent basis for this limitation in the claim.

10-3. Claim 11 is rejected as being dependent on the rejected claim 10.

10-4. Claim 12 recites the limitation “the previous and next edge” in line 3 of the claim. There is insufficient antecedent basis for this limitation in the claim.

10-5. Claims 15 and 16 recite the limitation “step of finding three initial points” in line 1 of each claim. There is insufficient antecedent basis for this limitation in the claim.

### ***Claim Rejections - 35 USC § 102***

11. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

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12. Claims 1, 13-14, and 26-30 are rejected under 35 U.S.C. 102(a) as being anticipated by Crossno et al., "Spiraling Edge: Fast Surface Reconstruction from Partially Organized Sample Points", Proceedings of Visualization '99, October 1999, pages 317-324.

12-1. Regarding claim 1, Crossno et al. disclose a method for reconstructing the surface of an object, said method comprising the steps of:

obtaining multiple sets of three-dimensional scan data of said object (set of points, page 318, left column, paragraph 1);

finding a seed triangle in said scan data to form a triangulated mesh (start with three points, page 319, left column, last paragraph);

pivoting a ball around an edge of said triangulated mesh until a new point in said scan data is hit by said ball, wherein said edge and said new point define a new triangle; adding said new triangle to said triangulated mesh (traversing the edge ring, page 319, left column, section 5; Figure 2);

selecting a new edge of said triangulated mesh and repeating said pivoting and adding steps until said surface is reconstructed (has finished triangulation, page 318, right column, paragraph 2).

12-2. Regarding claim 13, Crossno et al. disclose said step of pivoting a ball further comprises the step of labeling said edge as a boundary edge if no other point is hit by the ball (edge ring is two boundary points, page 322, left column, section 7.1).

12-3. Regarding claim 14, Crossno et al. disclose a method for reconstructing the surface of an object, said method comprising the steps of:

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- i. obtaining multiple sets of three-dimensional scan data of said object (set of points, page 318, left column, paragraph 1);
- ii. placing a ball of a given radius in contact with three initial points in said scan data, said three initial points forming a one-triangle mesh (start with three points, page 319, left column, last paragraph);
- iii. keeping said ball in contact with two points on the active-edge front of said mesh and pivoting said ball until it touches another point in said scan data, said two contact points forming an edge (traversing the edge ring, page 319, left column, section 5; Figure 2);
- iv. forming a new triangle with said triplet of points contacted by said ball (traversing the edge ring, page 319, left column, section 5; Figure 2);
- v. adding said new triangle to said mesh (placing edges, page 318, left column, paragraph 5);
- vi. selecting a new edge in said mesh and repeating steps iii. through v. (spirals around the edge ring, page 318, left column, paragraph 6).

**12-4.** Regarding claim 26, Crossno et al. disclose said step of pivoting a ball further comprises the step of labeling said edge as a boundary edge if no other point is hit by the ball (edge ring is two boundary points, page 322, left column, section 7.1).

**12-5.** Regarding claims 27-28, these system claims include same method limitations as in claims 1 and 14 and are anticipated using the same analysis of claims 1 and 14.

**12-6.** Regarding claims 29-30, these article of manufacture claims include same method limitations as in claims 1 and 14 and are anticipated using the same analysis of claims 1 and 14.



***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. Claims 5, 7, 18, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Crossno et al., "Spiraling Edge: Fast Surface Reconstruction from Partially Organized Sample Points", Proceedings of Visualization '99, October 1999, pages 317-324, in view of Pulli et al., "Robust meshes from multiple range maps", Proceedings of International Conference on Recent Advances in 3-D Digital Imaging and Modeling, May 1997, pages 205-211.

14-1. Regarding claims 5 and 7, Crossno et al. fail to expressly disclose: (1) scan data is acquired using a laser range scanner; and (2) the step of registering said scan data to align said multiple sets of scan data into a single coordinate system.

Pulli et al. disclose a method for modeling the surface of an object from a sequence of range maps (Pulli, abstract). Pulli et al. also teach that surface reconstruction from range data involves four major steps including the "Registration" step such that the collection of views (range maps) are registered into a common object-centered coordinate system (Pulli, page 205, section 1, Introduction).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Crossno et al. to incorporate the teachings of Pulli et al. to obtain the invention as specified in claims 5 and 7 because Pulli et al. disclose not only the real

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world data acquisition step but also the well-known steps for surface reconstruction from range data.

**14-2.** Regarding claims 18 and 20, Crossno et al. fail to expressly disclose: (1) scan data is acquired using a laser range scanner; and (2) the step of registering said scan data to align said multiple sets of scan data into a single coordinate system.

Pulli et al. disclose a method for modeling the surface of an object from a sequence of range maps (Pulli, abstract). Pulli et al. also teach that surface reconstruction from range data involves four major steps including the “Registration” step such that the collection of views (range maps) are registered into a common object-centered coordinate system (Pulli, page 205, section 1, Introduction).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Crossno et al. to incorporate the teachings of Pulli et al. to obtain the invention as specified in claims 18 and 20 because Pulli et al. disclose not only the real world data acquisition step but also the well-known steps for surface reconstruction from range data.

***Allowable Subject Matter***

**15.** Dependent claims 2-4, 6, 8-12, 15-17, 19, and 21-25 are not taught by the prior art of record and would be allowable if rewritten to overcome the rejections under 35 U.S.C. 112, first and second paragraph, set forth in this Office action and rewritten in independent form including all of the limitations of the base claim and any intervening claims.

*Conclusion*

16. The prior art made of record and not relied upon is considered pertinent to Applicant's disclosure.

Reference to Mallet, U.S. Patent 5,465,323 issued November 7, 1995, is cited as disclosing an method for modeling a surface.

Reference to Kacyra et al., U.S. Patent 5,988,862 issued November 23, 1999, is cited as disclosing an integrated system for imaging and modeling three-dimensional objects.

Reference to Liang et al., U.S. Patent 6,606,091 issued August 12, 2003, and filed February 6, 2001, is cited as disclosing a system for interactive 3D object extraction from slice-based medical images.

Reference to Boissonnat, "Geometric Structure for Three-Dimensional Shape Representation", ACM Transactions on Graphics, Volume 3, Issue 4, October 1984, pages 266-286, is cited as disclosing a surface-based approach for three-dimensional shape representation.

Reference to Hoppe et al., "Surface Reconstruction from Unorganized points", Computer Graphics (SIGGRAPH '92 Proceedings), July 1992, pages 71-78, is cited as disclosing an algorithm for surface reconstruction.

17. Any inquiry concerning this communication or earlier communications from the Examiner should be directed to Herng-der Day whose telephone number is (703) 305-5269. The Examiner can normally be reached on 9:00 – 18:00.

If attempts to reach the Examiner by telephone are unsuccessful, the Examiner's supervisor, Kevin J Teska can be reached on (703) 305-9704. The fax phone numbers for the organization where this application or proceeding is assigned is (703) 872-9306.

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Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Herng-der Day  
June 28, 2004

*Thai Phan*  
Thai Phan  
Patent Examiner  
AU: 2128